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ELECTRICAL HEATING BODY AND METHOD OF MANUFACTURING THE SAME

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Fig. 1.

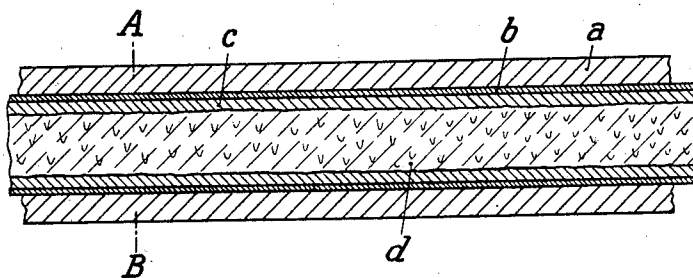
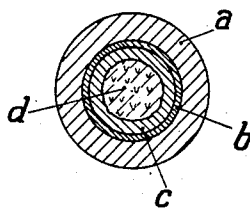


Fig. 2.



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ELECTRICAL HEATING BODY AND METHOD OF MANUFACTURING THE SAME

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This invention relates to resistors for domestic and industrial uses of all kinds. For all resistors having become known up to now a metallic resistance wire or platinum foil is used, and there exists in every case the invention to make the resistance as high as possible in order to reduce the consumption of current. Employing metallic resistances, especially in the shape of wire, entails very many drawbacks, among which may be mentioned that they burn through easily in that they become oxidized by the oxygen of the air, and the diminution of the sectional area thereby caused entails overloading of the remaining sectional area whereby the burning through is caused.

It has been tried to make use of carbon filaments as resistors because of the high specific resistance they have, and it has also been endeavoured to coat such filaments with metal oxides or carbonates in order to prevent them from burning, but none of the methods hitherto proposed has been successful. The coating or protective layer does not prevent the carbon filament from burning, in that, owing to the surface energy of the carbon, oxygen is absorbed from the air and supplied to the respective coating or protective layer; and if this latter consists of carbonates, it is redecomposed in a short time into carbonic acid and metal oxides.

Fig. 1 is a sectional view in elevation of the resistor.

Fig. 2 is an end view of the resistor.

All drawbacks hitherto encountered are completely obviated in the present improved method with the result that carbon filaments can be used as resistors for all imaginable purposes. The characteristic features of this method are these that, firstly, the filament is made, for instance, of graphite or gas coke so that its surface energy is the smallest possible, but the ground graphite or gas coke is not used directly in this state, but there are admixed to it such substances as are suited for the formation of a layer upon the filament, viz silicium oxides, calcium oxides, aluminium oxides, or the like, which all can only with difficulty be reduced in the presence of carbon. The mixture chosen is then turned

into a plastic composition with the aid of a suitable cementing medium, and this composition is transformed into filaments by means of a suitable press. The specific resistance of the filaments obtained can be determined, according to this method, either by the size of the grain of the metal oxide or oxides admixed to the pulverulent graphite or gas coke, or by the amount of the respective oxide or oxides, or by both causes, whereby it is rendered possible to determine the specific resistance of the finished filament in very wide limits so that the filament itself can be regarded as an insulator.

The filament produced in this manner is dried and inserted into a circuit in which it is heated to a temperature surpassing the service temperature by about 100° C., in consequence whereof there is formed upon the filament a layer of metal-carbonates which protects it for a certain short time from being burnt. While the current is passing through the filament the resistance of this latter changes according to the height of the temperature. The resistance is indicated by an ohmmeter also inserted into the circuit, and the current is broken when the intended resistance has been reached.

But, as already said, the layer formed protects the filament from being burnt only for a short time, as the carbonates are re-converted into carbonic acid and metal oxide by the heating in the air.

Many experiments have disclosed the fact that the thus formed layer, even if being very thin, possesses a very high insulating capacity also at a relatively high temperature as long as it consists of carbonates.

When the first phase of the procedure has been carried out in the above-described manner and the entire resistor has been provided with an insulating layer, a metal or an alloy is cast around it. There may be used for this purpose all metals and metal-alloys which do not melt at the service heating, as, for instance, bronzes, aluminium, and the like. While the respective metal or alloy is cast around the heating body current is again conducted through it until the surface of the metal or alloy is so much cooled down that

the latter solidifies; then the current is switched off. Heating the body during the casting procedure is necessary in order to prevent it from being distorted owing to the different coefficients of expansion of the materials.

The metallic covering of the filament prevents, by the pressure it exerts upon the filament, the decomposition of the layer of metal carbonates, and at the same time a thermic closure is attained which prevents absolutely securely oxygen from getting access to the filament. As, therefore, porous substances permeable to gas are no more used for the manufacture of the heating body a carbon filament of the above-described kind cannot burn, and also decomposition of the carbonate layer formed is absolutely securely prevented. And as, finally, also changes of the sectional area are perfectly impossible and the metallic envelope renders the entire heating body very strong in mechanical respect the life of the heating bodies produced according to this improved method is very long. This method permits to manufacture resistors of all shapes and for all purposes. If the heating bodies are intended for industrial bodies metal oxides with a very high fusing point, such as zirconium oxide, thorium oxide, or uranium oxide, are admixed to the carbon filaments.

I wish it to be understood that instead of providing the filament with only one layer of a metal carbonate two or even more such layers may be provided thereon. A filament with two layers of metal carbonates is illustrated by way of example on the accompanying drawing, drawn to a greatly enlarged scale, Figure 1 showing a portion of this filament in longitudinal section, and Figure 2 showing it in transverse section in the plane A—B of Fig. 1. On the drawing *d* denotes the filament proper which is manufactured in the manner described in the preceding part of this specification and consists of such substances as there stated; *c* denotes an insulating layer of aluminium carbonate, *b* an insulating layer of calcium carbonate, and *a* is the exterior, comparatively thick protective layer of a metal or alloy.

I claim:

1. The method of producing resistors, consisting in mixing carbon with metal oxides, turning the mixture into a plastic mass, forming bodies of this mass with the simultaneous application of pressure, burning the respective bodies until a layer of a metal carbonate has formed upon them, and casting a layer of a metal around them, substantially as set forth.

2. The method of producing resistors, consisting in mixing carbon with metal oxides, turning the mixture into a plastic mass, forming bodies of this mass with the simultaneous application of pressure, heating the

respective bodies electrically until a layer of a metal carbonate has formed upon them, and casting a layer of a metal around them, substantially as set forth.

3. The method of producing resistors, consisting in mixing carbon with metal oxides, turning the mixture into a plastic mass, forming bodies of this mass with the simultaneous application of pressure, inserting the respective bodies into an electric circuit, traversed by a suitable current, and heating them electrically until a layer of a metal carbonate has formed upon them, and casting a layer of a metal around them, substantially as set forth.

4. A resistor, comprising a core of a mixture of carbon and metal oxides, a layer of a metal carbonate surrounding said core, and a layer of a metal surrounding the first-mentioned layer, substantially and for the purpose set forth.

5. A resistor, comprising a core of a mixture of carbon and metal oxides, an insulating layer of a metal carbonate, and a protective layer of a metal, substantially as described.

6. A resistor, comprising, in combination, a core of a mixture of carbon and metal oxides, consecutive layers of metal carbonates surrounding and enclosing tightly said core, and a metallic layer cast upon and around the outermost of the first-mentioned layers, substantially and for the purpose set forth.

7. A resistor, comprising, in combination, a core of a mixture of carbon and metal oxides, a layer of aluminium carbonate, a layer of calcium carbonate, and a layer of a metal substantially and for the purpose set forth.

In testimony whereof I have affixed my signature.

HUGO LOHMANN.